UNITED STATES DEPARTMENT OF AGRICULTURE
US FOREST SERVICE
EASTERN TREE SEED LABORATORY
P.O. BOX 819
MACON, GEORGIA 31202

1360
January 15, 1976

TO: Seedsmen, Nurserymen,
Tree Improvement Specialists
and Seed Researchers

The recent Seed Handling and Testing Workshop was well attended by Federal, State, and Private Industry personnel. There were 72 participants from 17 states.

Attendees and others have requested published information presented at the sessions. Since a Workshop proceedings will not be published, we have put together a synopsis of the papers presented for your reference. If you wish to know more about any presentation, please write directly to the speaker. Complete addresses have been provided for your convenience.

In the fall of 1977 the Eastern Tree Seed Laboratory will sponsor a seed processing workshop featuring seed cleaning demonstrations and discussions of the processing of small to medium sized seed lots. In the interim, one or two Cone Analysis Service workshops are planned for 1976. These will provide guidelines and actual analysis work sessions. Federal, State, and Private Industry Organization personnel are invited to attend to learn how to apply cone analysis for making evaluations of actual and potential pine seed production.

Any comments you may have will be greatly appreciated.

Sincerely,

Earl W. Belcher

DR. EARL W. BELCHER, JR.,
Director, Eastern Tree Seed Laboratory

Enclosure (1):
Seed Handling and Testing Workshop Synopsis

SYNOPSIS OF THE
1975
SEED TESTING AND HANDLING WORKSHOP

RECENT FINDINGS IN CONE MATURITY

Presented by
Dr. William Pawuk
Research Plant Pathologist
Southern Forest Experiment Station, USFS
2500 Shreveport Highway
Pineville, LA 71360

Early cone harvesting can extend the cone collecting period permitting more cones to be harvested when labor is in short supply. Storing immature cones for 3 to 5 weeks and allowing them to dry slowly at ambient temperatures is essential to allow the cones to mature and give satisfactory yields of seed. While storage will have no effect on the viability of loblolly seed, the germination capacity of slash pine seed is increased with storage. However, the germination capacity of early collected longleaf seed is reduced with increased cone storage.

The following chart gives guidelines for initiating cone picking operations. Cones should not be picked before the specific gravity (SG) reaches those indicated. (Note: Be sure of the SG of the 20 wt oil you are using, as this may vary with the manufacturer.)

SPECIES	PICK		STORE	
	FLOAT	SG	YIELD	VIABILITY
Loblolly	Water	1.00	+	0
Slash	Lindseed Oil	.95	+	+
Longleaf	20 Wt Oil	.89	+	-

References:

1. McLemore, B. F. 1975. Collection date, cone-storage period affect southern pine seed yields, viability. Tree Planters Notes, Vol. 26, No. 1, pp. 24-2

SEED ANALYSIS OF ORCHARD CONES

Presented by
Dr. David Bramlett
Research Plant Physiologist
Southeastern Forest Experiment Station, USFS
P.O. Box 5106
Macon, Georgia 31202

The annual performance of seed orchards can be effectively measured by a cone analysis procedure. The analysis gives the seed potential of sample cones and determines the seed efficiency of each cone as a ratio of the filled seed yield to the seed potential. Seed losses are classified as first-year and second-year aborted ovules and also as empty seed. To reduce seed losses it is important to: (1) Identify the causes of seed losses; (2) give quantitative estimates of the amount of seed lost for each cause and (3) prescribe corrective control procedures to prevent the losses. If seed losses can be effectively reduced, seed yields should show substantial increases.

RECENT FINDINGS IN SEED AND CONE INSECT RESEARCH

Presented by
Dr. Harry Yates, III
Principal Research Entomologist
Southeastern Forest Experiment Station, USFS
Forestry Sciences Laboratory
Carlton Street
Athens, Georgia 30602

Regional Furadan® seed orchard test. The carbamate-insecticide carbofuran (=Furadan®) is a systemic which has proven very effective in controlling both the leaffooted pine seedbug and coneworms in seed orchards. The granular formulation is applied around the tree within the dripline and raked into the soil. Early season application (February) is recommended. Data from both the 1974 and 1975 regional Furadan® seed orchard tests will be sent in early 1976 to the insecticide manufacturer for submission to EPA for registration approval. Hopefully, registration will be granted in time for use in seed orchards for the 1977 season.

Seed and Cone Insects of Southern Pines

This recently published guide covers all insects that limit seed production of pines in seed orchards. Provided are color illustrations of the insects and their damage, tables on insect hosts and insect attack periods, non-technical writeups on all insect species, and easily used keys to species.

PATHOGENS AFFECTING SEED YIELD

Presented by
Dr. Thomas Miller
Research Plant Pathologist
Southeastern Forest Experiment Station, USFS
Forestry Sciences Laboratory
Carlton Street
Athens, Georgia 30602

Initial investigations of flower and conelet mortality indicate that fungi may be involved in the premature loss of conelets. Fungi have been isolated and have also been observed microscopically in the internal organs of dead and damaged flowers and conelets. Examination of mature slash pine cones with fungal mycelium on the exterior has shown that many seeds are also infected by fungi. Seeds from these cones have a reduced viability compared to seed from non-affected cones. Microscopic examination of seed from mature slash pine cones without observable signs or symptoms revealed that fungi may be present in the endosperm and embryo of seeds that are classified as healthy based on floatation and radiography.

UPGRADING SEED LOTS

Presented by
Dr. Frank Bonner
Project Leader
Timber Management Research
Southern Forest Experiment Station, USFS
Forest Tree Seed Lab
P.O. Box 906
Starkville, MS 39759

Upgrading The improvement of the potential performance of a seed lot by removal of empty, damaged, weak, immature, or odd-sized seeds.

Methods Which Can Be Used:

(A) Specific gravity by floatation
- oak, hickory, walnut - water
- *sugar maple, longleaf pine - pentane
- *loblolly pine - water
- *shortleaf, spruce, and sand pines - 95% ethyl alcohol
- *slash pine - 50% ethyl alcohol

(B) Air-screen cleaners

(C) Air separators, or aspirators

*Very small lots only

(D) Gravity separator
(E) Magnetic separators (experimental)
(F) X-ray - (specialized application)

Species Prescriptions:

(A) oaks - float, size by screens if desired
(B) hickory, walnut - float
(C) yellow-poplar[1] - dewing
clean
gravity separator
(D) southern pines[2] - dewing
clean
gravity separator
(E) sycamore[3] - clean (extra good)
gravity separator
(F) sweetgum - clean
air-screen cleaner repeat, with adjusted air-flow

1/ See: Bonner and Switzer. 1971. USFS Res. Note SO-129 "Upgrading Yellow-poplar Seeds."
2/ See: Switzer. 1959. J.F. 57:497-499.
3/ See Bonner and Switzer. 1974. SE Nurs. Conf. pp. 95-100. "Mechanical Separation of Full and Empty Sycamore Seeds."

SEED NEEDS FOR CONTAINER GROWN SEEDLINGS

Presented by
Mr. William Balmer
Forestation Specialist
USFS, Cooperative Forestry
1720 Peachtree Road, N.W.
Atlanta, GA 30309

Uniform, clean seed is at a premium for container operations. Container grown seedlings for economic reasons and narrow time constraints, requires precision seeding with predictable and rapid germination. Empty cells, whether a result of poor seeding or poor germination, add cost through the extra seed required to oversow, labor to replant empty cells, and/or labor costs to ship cells with multiple seedlings.

TREE SEED TESTING: SERVICES OFFERED BY THE EASTERN TREE SEED LABORATORY

Presented by
Mr. Robert Karrfalt
Assistant Laboratory Director
Eastern Tree Seed Laboratory
P.O. Box 819
Macon, GA 31202

Several free services are offered to assist those handling forest tree and shrub seed to obtain and maintain high quality seed lots. These include: detection of seed damage caused by extraction equipment, evaluation of gravity separation for individual lots and visitation, by request, for on site assistance. A forest reproductive materials clearinghouse also assists buyers and sellers of available material.

Routine service tests are conducted at cost and include determination of germination, seed per pound, purity and moisture content. Supplemental services, at additional costs, include: rush service, hourly charge for testing seed by a proposed work plan, and quick estimates of viability by excised embryo, tetrazolium and x-ray.

The SOSET and CAS programs, for pine species, estimate the amount and quality of realized seed yield. CAS also provides an estimate of potential yield and causes of seed loss. Cost estimates for both are available on reque

NURSERY AND TREE IMPROVEMENT ASSISTANCE AND CONTACTS

Presented by
Dr. Clark W. Lantz
Nursery-Tree Improvement Specialist
U.S. Forest Service
141 E. Trinity Place
Decatur, GA 30330

As the Nursery-Tree Improvement Specialist for the Southeastern Area of State and Private Forestry, I will have responsibility for an area including 13 states, about 60 forest tree nurseries, and over 6,000 acres of seed orchards.

I hope to be able to provide new sources of information for field personnel, improve the communications between research and operations, and help with specific problems as they occur.

There are many pressing issues such as:

-The environmental problems and attending constraints placed on the use of insecticides and herbicides,

-greater need for faster and more efficient cone harvesting,

-increased nursery production in spite of a decreasing labor supply.

INSTANT WEATHER FOR NURSERIES

Presented by
Dr. Jim Paul
Research Meteorologist
Southeastern Forest Experiment Station
P.O. Box 5106
Macon, Georgia 31202

Meteorological conditions favoring seedling infection by fusiform rust have been described by Snow and others. Many nursery operations are limited by atmospheric events, and weather elements can produce disastrous results in a tree nursery. Timely weather information, both observed and forecast, is needed on the user scale (weather for the nursery site itself, not for a state or region) and described in terms of weather effects. Such specific forecasts can be used by the nurseryman to limit his losses to extreme conditions, as well as to plan spraying, sowing, irrigation, and lifting operations. Using National Weather Service end-products (locally observed date and large scale forcasted date), a conceptual system has been designed to deliver specialized interpretations of weather events to a localized, forested site. The nurseryman could then call on the computer for weather at his location (observed/interpolated, and forecast), and could command an assessment of the weather impact on his daily operation. He could also contact a duty meteorologist for special interpretations or other assistance.

This may be an expensive system to initiate, but when installed and serving the entire forest community, should be a cost efficient system.

IMPORTANCE OF SEED MOISTURE DETERMINATION

Presented by

Dr. Frank Bonner
Project Leader, TMR
Southern Forest Experiment Station
Forest Tree Seed Laboratory
P.O. Box 906
Starkville, MS 39759

and

Dr. Earl W. Belcher
Director
Eastern Tree Seed Laboratory and
U.S. Forest Tree Seed Center
P.O. Box 819
Macon, GA 31202

A. Why do you need to know moisture content?

1. Most important factor in viability retention.
2. Insect and disease activity at certain levels.

% H_2O	Activity in Storage
8-9	Insects
10-12	Molds
16 Up	Heat from R S
30 Up	Germ. at high temp.

3. To relate weight to number of seeds.

B. When to measure it?

1. After extraction and cleaning.
2. Going into storage.
3. Periodical checks during storage.
4. Shipping seed lots.

C. How to measure it?

1. Oven-drying - overnight at 105° C.
2. Toluene, distillation, or other lab methods.
3. Electric meters.

D. Equilibration data

1. At room temperature (20°-25° C.), most seeds will equilibrate at:
   34-40% RH - 7-9%
   55-60% RH - 10-12%
   90-95% RH - 16-20%
2. At cold-room temperature (3°-5° C.), most seeds will equilibrate at:
   40-50% RH - 8-10%
   95% RH - 15-21%

CALIBRATION CHART FOR RADSON, DOLE & BURROWS ELECTRONIC MOISTURE METER

A brief explanation on operation of the 200, 300 or model 400 meter is as follows: (1) with unit on balance needle in the 'on' position with first mark on scale A at zero, (2) pour sample into hopper, (3) turn 'on' and dial until needle rebalances, (4) read directly from scale 'A' and consult calibration chart.

Percent Moisture Content	Pond Pine	Douglas Fir	Alpine Fir	White Fir	Lodgepole Pine	White Pine	Red Pine	Colorado Blue Spruce	Shortleaf Pine	Limber Pine	Engelmann Spruce	(Dewinged) Longleaf Pine	(Winged) Longleaf Pine	Ponderosa Pine	Virginia Pine	Loblolly Pine	Slash Pine	Scotch Pine	White Spruce	Balsam Fir	Norway Spruce
	(Meter Reading of 'A' Scale)																				
6.0	76	52	40	42	73	78	76	78	76	78	79	45	41	79	74	78	70	75	44	52	56
6.5	78	56	45	47	76	80	79	83	80	82	84	46	43	82	77	81	74	79	47	55	59
7.0	80	60	50	52	80	83	82	87	82	85	88	48	45	85	79	84	77	83	49	57	61
7.5	81	63	55	57	84	86	84	92	85	89	94	50	47	88	82	87	81	87	53	60	64
8.0	84	67	60	62	88	90	88	96	88	93	99	52	49	92	86	90	84	91	56	62	67
8.5	86	71	66	68	92	94	91	101	92	97	104	53	50	96	88	93	87	96	60	65	71
9.0	89	75	71	74	96	98	94	106	95	101	109	55	52	100	92	95	91	100	65	68	74
9.5	92	79	77	79	100	104	98	112	99	105	114	57	54	104	96	98	94	104	70	72	78
10.0	96	83	83	85	104	108	102	118	103	109	121	58	56	108	100	101	97	108	76	75	82
10.5	100	87	88	90	108	114	106	126	107	112	128	60	58	113	105	103	100	113	83	78	86
11.0	105	91	94	96	113	119	111	134	112	118	137	62	60	118	110	106	101	118	92	83	91
11.5	110	95	100	102	118	124	114	142	116	122	146	64	62	123	114	109	105	122	101	86	95
12.0	114	99	106	107	122	129	118	150	120	126	157	66	63	128	119	111	108	126	111	91	100

*Prepared at Eastern Tree Seed Laboratory in cooperation with Eaton Corporation.

CALIBRATION CHART FOR RADSON, DOLE & BURROWS ELECTRONIC MOISTURE METER

A brief explanation on operation of the 200, 300 or model 400 meter is as follows: (1) with unit on balance needle in the 'on' position with first mark on scale A at zero, (2) pour sample into hopper, (3) turn 'on' and dial until needle rebalances, (4) read directly from scale 'A' and consult calibration chart.

Percent Moisture Content	Red-osier	Silky Dogwood	Amur Honeysuckle	Tartarian Honeysuckle	Grand Fir	Western Larch	Ninebark
							(Meter Reading of 'A' Scale)
6.0	73	78	62	74	66	68	75
6.5	76	80	66	77	71	72	77
7.0	78	82	69	80	76	74	80
7.5	80	84	73	82	80	77	82
8.0	83	86	76	85	85	80	85
8.5	85	88	80	88	89	83	87
9.0	88	90	83	90	94	86	90
9.5	90	93	87	93	98	89	92
10.0	92	95	91	96	103	92	95
10.5	95	97	94	98	107	95	98
11.0	97	99	98	101	112	98	100
11.5	100	101	101	104	116	101	103
12.0	102	104	105	106	121	104	105

*Prepared at Eastern Tree Seed Laboratory in cooperation with Eaton Corporation.

**Charts soon to be available from Dr. Bonner for sycamore, sweetgum, black cherry, and dewinged yellow poplar.

PROCEDURE FOR
PREPARATION OF MOISTURE CHARTS

1- Select a pound or more of at least two lots.
2- Place either 85 or 142 grams (depending on seed size) in the electronic meter and record reading.
3- Take a subsample of 5-20 gm. of this seed and dry in the oven for 24 hours at 105°C (follow steps on attached sheet) then cool for 2 hr. in dessicator.
4- Put remainder of meter sample back into original lot and discard oven samples.
5- Readjust moisture of seed to any given level and begin again. Adjust moisture by the following:

Wet weight of sample - (wet wt. of sample x calculated moisture content) = dry wt. of wet sample.

Example: Assume you dried 5 gm. in the oven and found the moisture content to be 8.6%; then 85 gm. would equal

$$85 - (85 \times 0.086) = 85 - 7.31 - 77.69 \text{ gm. (dry wt.)}$$

To increase the moisture to:

10% = 0.10 x 85 = 8.50 - 7.31 =1.29 gm. of water to add
15% = 0.15 x 85 =12.75 - 7.31 =5.44 gm. of water to add

The easiest way to handle this is to divide all the seed into 85 gm. (or 142 gm.) samples and place in separate bottles. Use one to find the actual moisture and then add water by weight to the others to get the moisture you desire. The water should be added as a fine spray on the seed so the moisture content will equalize quickly. The seed should be left overnight in the jars before using.

POINTS TO REMEMBER:

- Don't handle seed containers which will go in the oven with hands as sweat will increase the weight.
- When seed are removed from the oven, they must be cooled to room temperature before being weighed. To prevent an increase in moisture, this should be done by placing the seed containers in dessicators (glass containers with tight lids and having calcium carbonate or silica jel in the bottom).
- Seed weights should be read to two places for reasonable accuracy.

The electronic meter readings are then plotted on graph paper against the actual moisture content. When ample points are available, a regression is run on the data. A chart is then prepared for each desired moisture level from the regression equation.

PREPARATION OF MOISTURE CALIBRATION
CHARTS FOR DOLE 400 METER

Date _____ Species Name _____

Name Of Preparers _____ Sample Size For Meter _____

		Lot #1		Lot #2	
Desired Moisture	Sample	Meter Reading	Actual Oven Moisture	Meter Reading	Actu Oven Moi
less than 6%	1				
	2				
	3				
	4				
6-8%	1				
	2				
	3				
	4				
8-10%	1				
	2				
	3				
	4				
10-12%	1				
	2				
	3				
	4				
above 12%	1				
	2				
	3				
	4				

Meter readings should be made on either 85 gm or 142 gm depending on seed size. The seed hopper should be more than half full. Oven reading should be made on a sub sample of the same seed the weight of which is reflected by seed size. For spruce the sample dried should not be less than 5 gm and for ponderosa pine 20 gm.

DETERMINATION OF SEED MOISTURE CONTENT BY OVEN DRYING

MOISTURE CONTENT:

Wt. of wet seeds + basket _____

Wt. of basket _____

Wt. of wet seeds _____

Wt. of dry seeds + basket _____

Wt. of basket _____

Wt. of dry seeds _____

Difference _____

Moisture content $\frac{\text{(Difference)}}{\text{(Wt. of wet seeds)}}$ X 100 _____ %

MOISTURE CONTENT:

Wt. of wet seeds + basket _____

Wt. of basket _____

Wt. of wet seeds _____

Wt. of dry seeds + basket _____

Wt. of basket _____

Wt. of dry seeds _____

Difference _____

Moisture content $\frac{\text{(Difference)}}{\text{(Wt. of wet seeds)}}$ X 100 _____ %

MOISTURE CONTENT:

Wt. of wet seeds + basket _____

Wt. of basket _____

Wt. of wet seeds _____

Wt. of dry seeds + basket _____

Wt. of basket _____

Wt. of dry seeds _____

Difference _____

Moisture content $\frac{\text{(Difference)}}{\text{(Wt. of wet seeds)}}$ X 100 _____ %

Three special interest group sessions were offered following the regular workshop.

VISIT TO GEORGIA FORESTRY COMMISSION'S ARROWHEAD SEED ORCHARD
Dr. Dave Bramlett

John Branan and Hall Jones gave the group an excellent tour of the Georgia Forestry Commission's Arrowhead Seed Orchard. Visitors inspected equipment for installing fabric for seed harvesting, equipment for separating pine seed from pine needles, tree shakers and the new experimental vacuum seed harvester. In the loblolly seed orchard procedures, costs and advantages of the nylon fabric were discussed. Thinning of slash pine orchards was viewed in the grafted orchard and compared to a seedling seed orchard.

VISIT TO GEROGIA FORESTRY COMMISSION'S MORGAN NURSERY
Mr. Robert Karrfalt

The visit began in the packing shed. Here a weighing procedure for packaging was being used, instead of counting the seedlings. Many aspects of nursery operations were discussed and ideas exchanged while inspecting sowing and harvesting equipment. A walk out to the field to observe conditions in the beds concluded the visit.

SEED CERTIFICATION DISCUSSION
Dr. Earl Belcher

The steps to achieve seed certification were outlined with an explanation of OECD (Organization for Economic Cooperation and Development), state crop improvement agencies and their relationship to AOSCA (Association of Official Seed Certifying Agencies). A discussion ensued about the three major OECD categories:

-Source identified (yellow tag),
-Select tree seed (green tag), and
-Certified tree seed (blue tag).

While the green tagged seed is phenotypically superior, the blue tagged seed is proven to be genetically superior.

Foreign countries are interested in OECD tags and ISTA (International Seed Testing Association) certificates. The ISTA certificates come in three colors:

-Orange (seed sampled and sealed by issuing station or another officially authorized agency),
-Green (samples taken in one country but tested in another), and
-Blue (test on sample as received when green or orange does not apply).